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IPM Research Highlights

This special edition of the newsletter provides a timely introduction and description of newly available technology. The information is concerned with predicting changes in southern pine beetle numbers or beetle- and disease-caused tree mortality. The user is encouraged to select an appropriate technique by the geographic area in which each system was developed and tested. We also encourage users to distribute some or all of this information to associates, clients, or cooperators through their own newsletters, training sessions, fact sheets, technology tips, and to contact the appropriate individual identified with each technique if there are questions or problems.

If you use this information in any way, the Program would appreciate knowing how it was used, whether it met user needs in a realistic way, and whether users have suggestions for improving the techniques that might be passed on to the developers.

SPB COMP

Purpose: To predict a change in southern pine beetle-infested area from the previous year for specific climatic districts.

Description: SPB COMP uses temperature and precipitation values from January through June to predict changes in area of SPB infestation. The model currently applies to multi-county climatic districts in the Piedmont and Coastal regions of Virginia, North Carolina and South Carolina.

The temperature-precipitation data file used in this effort covers 100 climatic Districts in the southeastern U.S. for the 1960 – 1980 period. Monthly weather data for the same area for a 48-year period have been used to calculate seasonal variation in temperature and precipitation.

Inputs: Estimates or observed values of mean monthly temperatures and monthly precipitation totals for January through June.

Outputs: Percentage change in beetle-infested area (epidemic counties) in the climatic district from previous year and a qualitative indicator of the model's confidence in its prediction.

Accessibility: Users with access to a computer terminal and phone hookup may run the model interactively on the University of Virginia's computer.

Logon Information

Call Univ. Va. Computer Center:

(Nos. for 300 BAUD) (804) 924-0285 924-0300 924-7251	(Nos. for 1200 BAUD) (804) 924-0280 924-7401
Computer	*User Response*
(Tone)	(return)
Enter Class	7 (return)
Class 007 Start	(Wait 5 sec; return, return)
"Login Info" . . . Login Please	Login (return)
User name	5885MJB (return)
Password	Martha (return)
Enter Interactive Program	

Additional Information: Questions regarding the model or its use may be addressed to: Dr. Patrick J. Michaels, State Climatologist, Department of Environmental Sciences, Clark Hall, University of Virginia, Charlottesville, VA 22903, Telephone: 804/924-0549.

Clembeetle

Purpose:

To simulate expected SPB loss for a single stand or for multiple stands for periods as short as a year or as long as a rotation.

Description:

Losses can be simulated for natural and planted loblolly and natural shortleaf pine stands in the Piedmont and Gulf Coastal Plain. The effect of thinning on growth and volume yield and on expected loss in loblolly pine stands can be evaluated. The program permits the user to estimate the probability of SPB spot occurrence and the number of trees killed as a result of spot growth. Expected loss is expressed as the average number of trees killed per acre. Volume losses are based on the number and size of trees killed.

Inputs:

Required:

Piedmont

1) Forest type
2) Landform
3) Soil texture

Gulf Coastal Plain

1) Percent pine
2) Landform

Required for both regions:

1) Site index
2) Initial age
3) Basal area/acre

Outputs:

1) Probability of infestation occurrence
2) Trees killed if a spot does occur
3) Expected number of trees killed per acre
4) Volume of timber killed per acre
5) Percent of volume killed due to SPB attack

Accessibility:

The simulation system is available as an interactive FORTRAN computer program. A manuscript providing a detailed description of the system is available. The program may be accessed through the Clemson University computer.

Additional Information:

Questions regarding this model and its use may be addressed to: Dr. Roy L. Hedden, Professor, Department of Forestry, Clemson University, Clemson, SC 29631, Telephone: 803/656-3303.

MS Hazard B

Purpose:

To determine the relative hazard of timber stands to southern pine beetle attack.

Description:

Kushmaul et al. (1979) developed three models from data collected from uninfested and infested stands in Mississippi, Louisiana, and Arkansas. Nebeker and Honea (Mississippi State University) selected and modified one of their models and identified five hazard classes. The model was used to successfully rate the relative hazard of many infested stands in 1983 and is applicable in Mississippi and Alabama.

Inputs:

1) Pine basal area/acre
2) Stand age
3) Stand density/acre
4) Site index
5) Total basal area/acre

Outputs:

A hazard classification which indicates the relative susceptibility of stands to SPB attack.

Accessibility:

Hazard classifications are obtained by calculating a discriminant score and determining which hazard class is associated with that score.

Score = 1.8342 (Pine BA) + 0.4085 (Total BA) + 0.705 (Age) + 0.002 (Stand density) + 0.88 (Site index) − 206.315

Hazard:
> 220 = Very high
168 – 219 = High
62 – 167 = Medium
11 – 61 = Low
< 10 = Very low

This rating technique is available for use on Apple II and Apple II lookalikes.

Example:

If total basal area is 130 ft^2/ac, pine basal area is 110 ft^2/ac, the stand age is 27 years, stand density is 285 trees/ac, and site index is 109, the relative hazard would be determined as follows:

Score = (1.8342 × 110) + (0.4085 × 130) + (0.705 × 27) + (0.002 × 285) + (0.88 × 109) − 206.315 = 163.51

The score of 163.51 falls between 62 and 167. The relative hazard rating would be "Medium."

General References:

Kushmaul, R. J.; Cain, M. D.; Rowell, C. E.; Porterfield, R. L. Stand and site conditions related to southern pine beetle susceptibility. For. Sci. 25:656 – 664; 1979.

Nebeker, T. E.; Honea, C. R. Comparisons of selected southern pine beetle hazard rating systems in Mississippi. Mississippi Agricultural and Forestry Experiment Station Tech. Bull.; 1984. (In press).

Additional Information:

Questions regarding this model and its use may be addressed to: Dr. T. Evan Nebeker, Professor, or Ron Honea, Department of Entomology, Mississippi State University, Mississippi State, MS 39762, Telephone: 601/325-2085.

NF Risk

Purpose:

To rate relative risk of pine stands to southern pine beetle attack on National Forest lands.

Description:

The model is based on readily available resource data from the Continuous Inventory of Stand Conditions (CISC), an automatic data processing system that continually reflects an up-to-date description of timber stand conditions on National Forests in the South.

The rating system was developed for the Kisatchie National Forest in Louisiana, but also applies to National Forests in Texas and Mississippi. With some modification, the system could be used on any National Forest in the South. It provides the forest manager with an additional tool for selecting stands to thin or regenerate during a 10-year planning period.

Inputs:

Required:

Five data fields from CISC for rating stands: 1) Forest type, 2) stand condition class, 3) method of cut, 4) operability, and 5) site index.

Outputs:

Normal:

Computer printouts are generated that classify risk-rated stands as high, medium, or low risk.

A table is produced that shows the number of acres, number of stands, and percentage of acres in each of the three risk classes. This information is currently being used to update the CISC data file so that each stand in each compartment will eventually have a risk rating.

Accessibility:

The computer program for application of the stand risk rating system is online at the Ft. Collins computer center.

General References:

Three publications cover the philosophy and development of the model and details of its use and application:

Lorio, P. L., Jr. Developing stand risk classes for the southern pine beetle. Res. Pap. SO-144. New Orleans, LA: U.S. Dep. Agric., For. Serv. 1978. 9 p.

Lorio, P. L., Jr.; Mason, G. N.; Autry, G. L. Stand risk rating for the southern pine beetle: integrating pest management with forest management. J. For. 80: 212 – 214; 1982.

Lorio, P. L., Jr.; Sommers, R. A. Use of available resource data to rate stands for southern pine beetle risk. In: Hedden, R. L. et al., eds. Hazard Rating Systems in Forest Pest Management. Gen. Tech. Rep. WO-27. Washington, DC: U.S. Dep. Agric., For. Serv.; 1981. 169 p.

Additional Information:

Questions regarding this model and its use may be addressed to:

Wesley A. Nettleton, Entomologist, USDA Forest Service, Forest Pest Management, 2500 Shreveport Highway, Pineville, LA 71360, Telephone: 318/473-7160.

Dr. Peter L. Lorio, Jr., Project Leader, Southern Forest Experiment Station, 2500 Shreveport Highway, Pineville, LA 71360, Telephone: 318/473-7232.

Piedmont Risk

Purpose:

To determine the risk of natural stands suffering losses due to southern pine beetle attack in the Piedmont.

Description:

The system can be used to determine the need for cultural treatment. Possible cultural treatments include converting shortleaf pine stands to other species, harvesting overmature stands, and thinning younger stands to reduce stand density and improve tree vigor.

Information needed to determine potential loss from SPB infestation for individual stands can be obtained from plots within the stands or from office records. Stand inventory records, published soil surveys, and topographic maps can be used in the office. When field plots are used, several points should be established in each stand. At each point, the stand composition, pine basal area/acre, and slope percentage should be determined.

Risk, hazard, and potential loss values are calculated for each plot and then averaged for each stand. Stands are then ranked based on these average values.

Inputs:

1) Forest type
2) Landform
3) Soil texture
4) Radial growth (optional)
5) Pine basal area/acre
6) Local stumpage value for sawtimber and pulpwood

Outputs:

1) Likelihood of spot occurrence (risk)
2) Likelihood of spot spread (hazard)
3) Expected loss due to SPB attack

Accessibility:

A. To estimate risk of spot occurrence (check the line with the combination of inputs from above):

Shortleaf pine (>50%)	Steep slope (>10%)	Clay soil (>28%)	Radial growth last 5 years (in.)						Risk* class	Risk* value
			0	.1	.4	.6	.8	1.0		
yes	yes	yes	H	H	H	H	H	H	H	3
yes	no	yes	H	H	H	H	H	M	H	3
no	yes	yes	H	H	H	H	M	M	H	3
yes	yes	no	H	H	H	M	M	L	M	2
no	no	yes	H	H	H	M	M	L	M	2
yes	no	no	H	M	M	L	L	L	L	1
no	yes	no	H	M	M	L	L	L	L	1
no	no	no	M	L	L	L	L	L	L	1

*Average excluding radial growth.

The information on spot occurrence can be combined with potential spot spread to obtain a qualitative rating for potential loss. Spot spread (hazard) is directly related to pine basal area/acre. This measure of stand density is used to estimate the hazard from spot spread once an infestation is established.

B. To estimate likelihood of spot spread (hazard):

Pine basal area	Hazard	
(ft^2/acre)	Value	Class
>120	3	High
90 – 120	2	Moderate
<90	1	Low

C. To determine potential loss and need for treatment:
Loss value = Risk Value** + Hazard Value***
** From A above
*** From B above

Loss value	Potential loss	Need for cultural treatment
6	very high	extreme
5	moderately high	high
4	moderate	moderate
3	moderately low	low
2	very low	extremely low

D. To estimate potential economic loss:

Product	*dbh(in.)*	*Product value*
pulpwood	<9	1
sawtimber	>9	2

Potential economic loss = loss value + product value

Loss value	Potential economic loss
7 – 8	high
5 – 6	moderate
3 – 4	low

This rating technique is available for use on Apple II and Apple II lookalikes.

Additional Information: Questions regarding this model and its use may be addressed to: Dr. Roy L. Hedden, Professor, Department of Forestry, Clemson University, Clemson, SC 29631, Telephone: 803/656-3303.

Tambeetle

Purpose:

To predict spot growth and tree mortality resulting from existing southern pine beetle spots.

Description:

TAMBEETLE utilizes detailed information on beetle life processes, tree characteristics, stem distribution, and microclimatic conditions. An economics package is included to allow the user to translate tree mortality estimates into dollar values. Differing amounts of data can be used to run the model.

The system can be used for both natural and planted stands. The model was developed for use in natural loblolly pine stands in east Texas, but is considered applicable to other areas in the southern pine range having similar environmental and beetle population conditions.

Inputs:

Required:

1) Number of trees actively undergoing attack (Stage 1)
2) Number of trees containing eggs and developing broods (Stage 2)
3) Number of trees dead and no longer containing broods (Stage 3)
4) Pine basal area/acre and average dbh at the active head(s)
5) Time of year for prediction
6) Number of days for which spot growth is to be predicted

Recommended:

1) Average dbh of stand
2) Average height to bottom of crown
3) Landform

Optional for economic output:

1) Type of scale desired (Doyle, International, or Scribner)
2) Average merchantable height
3) Form class for sawtimber trees
4) Local stumpage prices for pulpwood and sawtimber

Optional tree and insect inputs:

1) dbh for each infested tree
2) Height to bottom of crown for each infested tree
3) Predominant life stage (egg, larval, pupal, adult) for each infested tree

Outputs:

Normal:

1) Biweekly cumulative number of trees killed and number of trees actively undergoing attack.

Optional:

1) Biweekly cumulative dollars lost due to infestation.
2) Daily cumulative number of trees killed and dollars lost.
3) Range in cumulative trees killed indicating random growth potential due to randomness in stem distribution and stand conditions.

Accessibility:

A *Users Guide* is available. Remote accessing of the model through interactive phone connection with Texas A&M University can be arranged by contacting: Wesley A. Nettleton, Entomologist, USDA Forest Service, Forest Pest Management, 2500 Shreveport Highway, Pineville, LA 71360, Telephone: 318/473-7160.

General Reference:

Turnbow, R. M.; Coulson, R. N.; Hu, L.; Billings, R. F. Procedural guide for using the interactive version of the TAMBEETLE model of southern pine beetle population and spot dynamics. MP-1518. College Station, TX: Tex. Agric. Exp. Sta.; 1982. 24 p.

Additional Information:

Questions regarding this model and its use may be addressed to: Dr. Richard M. Feldman, Associate Professor, Industrial Engineering Department, Texas A&M University, College Station, Texas 77843, Telephone: 409/845-5531.

Arkansas SPB

Purpose:

To predict short term changes in southern pine beetle numbers and tree mortality, and associated timber volume and monetary loss in currently infested loblolly and/or shortleaf pine stands.

Description:

The Arkansas SPB model uses computer simulation to aid forest managers in their decisionmaking. Data were collected from infested stands in southern Arkansas between 1975 and 1978. The model has been tested in other southern States. It is currently being refined to include consideration of a broader range of site, stand, and pest conditions found in southern forests.

Inputs:

Required:

1) Spot identification (for user's reference)
2) State in which infestation is located
3) Date the spot was ground checked
4) Desired number of days of prediction
5) Percentage of shortleaf and/or loblolly pine in the stand
6) Mean dbh of the stand
7) Mean pine and hardwood basal areas/acre
8) Number of trees currently infested by SPB
9) Number of trees from which SPB have already emerged

Optional:

1) Average radial tree growth over the last 5 years
2) Average tree age
3) General dbh distribution of the stand
4) Predominant SPB life stages (egg, larval, pupal, adult) present in the trees at breast height
5) Local stumpage prices for salvaged pine sawtimber and pulpwood

Outputs:

Normal:

Weekly prediction for the requested period of time of the numbers of currently infested and total dead trees.

Optional:

Estimate of total volume loss and associated monetary loss for the period of the simulation, based on the dbh distribution input for the spot.

Accessibility:

The model is accessed through a fast, easy, and inexpensive interactive computing system located at the University of Arkansas. A *User's Guide* is available. Remote accessing of the model through an interactive phone connection can be arranged by contacting: Wesley A. Nettleton, Entomologist, USDA Forest Service, Forest Pest Management, 2500 Shreveport Highway, Pineville, LA 71360, Telephone: 318/473-7160.

General Reference:

Stephen, F. M.; Taha, H. A. Validation, testing and implementation of a southern pine beetle damage and population prediction model. U.S. Dep. Agric., For. Serv., Prog. Rep. for 19-81-9; 1981. 13 p.

Additional Information:

Questions regarding this model and its use may be addressed to: Dr. Fred M. Stephen, Professor, Department of Entomology, A-319, University of Arkansas, Fayetteville, AR 72701, Telephone: 501/575-3377.

TFS Spot Growth

Purpose:

To predict tree mortality associated with the spread of individual southern pine beetle infestations during summer months.

Description:

The TFS spot growth model is based on east Texas infestation and stand characteristic data obtained during 1975. The model may apply to similar situations in other Western Gulf Coastal Plain States. Predictions are made for a 30-day period and are considered most applicable for spots ranging in size from 5 to 100 trees and occurring during the period May to October.

Inputs:

Required:

1) Number of infested trees
2) Total basal area (pine + hardwood)/acre
3) Freshly attacked trees present

Optional (computerized version):

1) Volume per tree
2) Stumpage prices for pulpwood and/or sawtimber

Outputs:

Normal:

1) Number of additional trees killed during next 30 days
2) Number of active (currently-infested) trees at end of 30-day period

Optional:

Economic losses over time

Accessibility:

See Texas Forest Service Circular 249.

The Texas Forest Service Spot Growth Model is also available in a computerized format and may be accessed by telephone by contacting:

Texas Forest Service, Pest Control Section, P. O. Box 310, Lufkin, TX 75901, Telephone: 409/632-7761.

Robert J. Uhler, Computer Specialist, USDA Forest Service, Forest Pest Management, Northgate Office Park, 3620 Interstate 85, NE, Doraville, GA 30340, Telephone: 404/221-4796.

Wesley A. Nettleton, Entomologist, USDA Forest Service, Forest Pest Management, Pineville, LA 71360, Telephone: 318/473-7160.

General Reference:

Billings, R. F.; Hynum, B. G. Southern pine beetle guide for predicting timber losses from expanding spots in east Texas. Circ. 249. College Station, TX: Texas For. Serv. 1980. 2 p.

Additional Information:

Questions regarding this model and its use may be addressed to: Dr. Ronald F. Billings, Principal Entomologist, Pest Control Section, Texas Forest Service, P. O. Box 310, Lufkin, TX 75901, Telephone: 409/632-7761.

SPB Decision Support System

Purpose:

To help forest and pest managers make better management decisions by using the latest available technology in an organized, interactive manner.

Description:

The southern pine beetle Decision Support System consists of a front-end routine called FERRET, which includes a listing of available technology, an informational component made up of computer models, data, and information files, and an executive routine that links and manages information from FERRET and the information system to provide answers to management questions. Five types of models are included in the system: 1) Stand hazard rating, 2) SPB population and spot dynamics, 3) economic impact analysis and stand management, 4) stand growth and yield, and 5) beetle-killed timber utilization.

Inputs:

1) User question regarding a southern pine beetle management problem.
2) Series of menus worked through by the program to define the question, leading to an OUTPUT report. (Only one question or problem can be analyzed at a time).
3) Other options: user can enter MODEL command which lists the model technology indexed by the program. Within this routine, user has option of reviewing the outputs, inputs, and a narrative description of each model in the system. Each model can be run independently.

Outputs:

1) For the MODEL command, a listing of models and the option of viewing a narrative description.
2) A selection of models from each of the five types listed above, or other technology in solving a particular problem.
3) If desired, one or more models selected by user and input data provided for running them.

Accessibility:

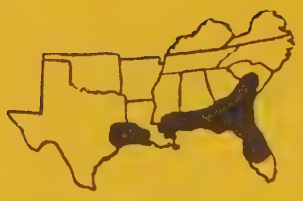
The SPB Decision Support System is an interactive FORTRAN code suitable for establishment on most mainframe type computer systems. Availability is currently limited to the Texas A&M University mainframe computer. For information on access, use, and possible computer charges, contact Dr. Robert N. Coulson.

General Reference:

Turnbow, R. H., Jr.; Hu, L. C.; Rykiel, E. J.; Coulson, R. N.; Loh, D. Procedural guide for FERRET, the question analysis routine of the decision support system for southern pine beetle management. MP-1533, College Station, TX: Tex. Agr. Exp. Sta.; 1983. 21 p.

Additional Information:

Questions regarding this model and its use may be addressed to: Dr. Robert N. Coulson, Professor, Department of Entomology, Texas A&M University, College Station, TX 77843, Telephone: 409/845-9725.



Fusiform Rust Yield—Slash

Purpose:

To predict yields for unthinned slash pine plantations infected with fusiform rust.

Description:

Rust mortality functions have been developed for unthinned slash pine plantations. Data were collected from plots in Louisiana, Mississippi, Alabama, Georgia, Florida, and South Carolina. The rust mortality functions were incorporated into an existing stand growth and yield model. The model requires rust level input at age 5 and predicts timber yields by diameter class at rotation age.

Inputs:

Stand characteristics

1) Site index
2) Trees/acre at age 5
3) Percent stems rust infected at age 5 (Note: Provision is made to simultaneously project yields of plantations having two different levels of stem infection at age 5.)
4) Projected rotation age
5) Index age for site index

Other

1) Minimum merchantable dbh class
2) Minimum merchantable top diameter (inside or outside bark)
3) Stump height
4) Coefficients for DSQH volume equation for estimating yield by this procedure

Outputs:

Full (not a complete list)

1) Stand characteristics at projected age by dbh class
   a) trees/acre
   b) basal area/acre
   c) crown ratio
   d) average height
   e) cubic foot volumes/acre
      1. total tree, stump to top (IB or OB)
      2. merchantable stem (IB or OB)
2) Yield/acre at projected age by DSQH equation
3) Per acre summaries of 1. and 2. for reference stand.

Brief

Per acre summaries of full output option

Provisions are made for multiple runs in which user specifies range in stand conditions and increments within these ranges (e.g. by specifying rust levels of 40 percent to 60 percent at 10 percent intervals, the user obtains final yield estimates for plantations having 40, 50, and 60 percent stem infection at age 5).

Accessibility:

This model is available on a no-computer-charge basis on a Forest Service computer at Gulfport, MS or New Orleans, LA. For access information, contact: Mr. Anthony Rayford, Mathematical Technician, USDA Forest Service, Forestry Sciences Laboratory, P. O. Box 2008 GMF, Gulfport, MS 39503, Telephone: 601/864-3972.

General Reference:

Nance, W. L.; Froelich, R. C.; Dell, T. R.; Shoulders, E. A growth and yield model for unthinned slash pine plantations infected with fusiform rust. In: E. P. Jones, ed.

2nd Biennial Southern Silvicultural Research Conference: symposium proceedings; 1982 November 4 – 5. Atlanta, GA. Gen. Tech. Rep. SE-24. Asheville, NC: U.S. Dep. Agric., For. Serv., Southeastern Forest Exp. Sta.; 1983: 275 – 282.

Additional Information: Questions regarding this model and its use may be addressed to:

Warren L. Nance, Geneticist, Forestry Sciences Laboratory, Southern Forest Experiment Station, Box 2008 GMF, Gulfport, MS 39501, Telephone: 601/864-3972.

Eugene Shoulders, Research Forester, Southern Forest Experiment Station, 2500 Shreveport Hwy., Pineville, LA 71360, Telephone: 318/473-7201.

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